Reporting Federal Activities and Matters of National Concern . . .

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Manpower Futures in NASA

C. GUY FERGUSON

The Changing Face of Education

FRANCIS KEPPEL

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE—Office of Education

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Manpower Futures in NASA

By C. GUY FERGUSON*

THE NATIONAL Aeronautics and Space Administration, established on October 1, 1958, is having an ever-increasing influence on every field of science and science related work. Not only has it begun to modify the occupations of considerable numbers of persons in the labor force but it is destined eventually to affect profoundly the lives of every American. The organization is devoted to the planning, administration, and execution of the Nation's peaceful aerospace activities, including the exploration of space for the peaceful uses of mankind. One of the most important aspects of NASA's program concerns its manpower resources, especially those in highly trained occupations.

When NASA was formed it was not an entirely new organization: it was formed of several able teams from the science of aeronautics and related fields. Members of these teams, drawn from the scientific research and development branches of the military organizations and the former National Advisory Committee for Aeronautics (NACA) gave meaningful expression to the importance of higher education in America. Both the military and NACA depended upon college graduates in science and engineering as the backbone of their technical work; 25 percent of the NACA staff members were aeronautical research scientists, an occupational group in which a degree in physical science or engineering from a recognized institution of higher learning was a prerequisite. Recognizing the importance of this education requirement, Robert J. Lacklen, NASA Director of Personnel, incorporated in the manpower program a technique for tapping the resources of our colleges and universities in staffing the growing space agency. His technique led to the development of the Aerospace Technology Examination for NASA's professional positions.

In its first years NASA's need for graduates in science and engineering, both experienced and inexperienced, was great, and the new organization grew rapidly, not only in size but also in the percentage of staff members who were scientists and engineers. On January 1, 1959, 33.5 percent of the staff were scientists and engineers. By January 1, 1963, the 9,240 scientists and engineers on the rolls constituted 36 percent of the NASA staff.

In order to transform these new staff members into an effective research and development team, a carefully planned manpower program was required. The first step and one of the most fundamental in this manpower program was the identification of the work being performed by NASA and the occupational specialties of the staff.

MAN'S sudden entry into space has had a dramatic impact on occupational specialties. In the past century scientific and engineering occupations fell neatly into categories which carried such titles as physicist, chemist, engineer, or mathematician. Even today most research and development organizations still use these titles, though they do not precisely describe the work being done. The space program drew personnel from many of the traditional academic areas of science and engineering, but being new, produced an entirely new pattern of occupations. These new professional occupations appear to be unrelated or only slightly related to the traditional academic categories. The

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Mr. Ferguson received his B.A. from the University of Virginia. He also attended Harvard Law School.

most important result of the emergence of these new occupational categories is the diversity of training and degrees possessed by aerospace technologists who are doing the same kind of work.

College training and academic degrees in any of the physical science or engineering disciplines appear to be a suitable foundation for most of the aerospace occupational specialties. In the past a few scientists became renowned in a field different from that of their academic training, but since the development of aerospace occupational categories many scientists have done so. A physical scientist or engineer becomes a specialist in an aerospace professional occupation by completing a basic undergraduate curriculum in his chosen field, and by building on this foundation in his later research and development experience.

It should be emphasized that the aerospace research and development specialties are not mere combinations of academic degree categories. Rather they are an entirely new pattern of occupations with only minor relationships to the various academic fields.

The aerospace scientific and engineering specialties, as they exist in NASA, are listed below:

Space sciences
Aeronomy
Ionospheres
Fields and particles
Stellar studies
Lunar and planetary studies
Meteoroid studies
Solar studies
Space sciences program management
Aeronomy program management
Fields and particles program management
Stellar studies program management
Lunar and planetary studies program management
Solar studies program management

Life sciences and systems
Life environmental studies
Bio-radiation studies
Behavioral studies
Environmental control
Life sciences program management
Behavioral studies program management

Fluid and flight mechanics
Flight mechanics
Control and guidance systems
Orbit and trajectory studies
Fluid mechanics
Magnetofluiddynamics
Aerostructural dynamics
Flight vehicle acoustics
Propulsion system dynamics
Heat transfer
Stability, control and performance
Flight vehicle atmospheric environment
Basic properties of gases
Control and guidance project management
Fluid and flight mechanics program management

Materials and structures
Materials
Structural materials
Basic properties of materials
Polymeric materials
Coating materials
Friction and lubrication
Structural mechanics
Flight structures
Materials and structures program management

Propulsion and power
Liquid propulsion systems
Solid propulsion systems
Electrical propulsion and power
Energy conversion
Nuclear energy processes
Nuclear propulsion and power
Chemical energy processes
Internal flow dynamics
Propulsion systems project management
Propulsion program management
Nuclear propulsion program management
Liquid propulsion program management
Electrical propulsion and power program management
Solid propulsion program management

Flight systems
Reliability
Flight systems test
Flight vehicle experimental techniques
Flight system experimental and operational techniques
Experimental manufacturing techniques
Mass measurements
Space vehicle project management
Spacecraft project management
Launch vehicle project management
Launch operations project management
Launch operations program management
Experimental manufacturing project management
Flight system program management
Spacecraft program management
Launch vehicle program management

Measurement and instrumentation systems
Sensors and transducers
Heat and light measurement
Force measurement

Measurement standards and calibration
Automated control systems
Nuclear measurement
Radio-frequency systems
Antennas
Telemetry
Electromagnetic propagation
Communication control techniques
Electronic flight and support equipment
Flight mission measurements
Life instrumentation
Measurement system project management
Tracking station management
Measurement and instrumentation system program management
Telemetry program management
Communication program management
Flight mission measurement program management

Data systems
Theoretical simulation techniques
Numerical analysis techniques

Data system program management
Experimental facilities and equipment
Experimental tooling and equipment

Fluid and flow systems
Electrical experimental equipment
Experimental facility techniques
Nuclear experimental techniques
Space center planning
Experimental facilities and equipment program management

Research piloting

Executive management
Project management
Technical management

Program management
Flight range coordination
Research grants and contracts program management
Advanced technology program management

Similar specialties in industry can best be recognized in the recruiting advertisements of research and development organizations which, to be effective, must list the specialty rather than the degree in order to attract persons qualified for the specialty.

The best method of illustrating the characteristics of this fundamental development of new occupations related to physical science and engineering is the listing of the degrees held by the professionals working in a given aerospace specialty and performing duties which are similar except for level. Similar duties are those that are, for all practical management purposes, sufficiently alike to permit persons to work in them interchangeably.

In April 1962 a study was made of the degrees held by NASA employees. The list below shows the number of NASA employees in six aerospace technology categories by the title of the degree they held. (This study was limited to the highest degree held; either the doctorate, the master's, or the bachelor's degree. At the time the study was made, the bachelor's degree was the highest degree held by 79 percent of the employees.)

Control and guidance systems, total degrees, 175

Aeronautical engineering, 39
Chemistry, 1
Civil engineering, 1
Electrical engineering, 49
Electronic engineering, 3
Mathematics, 18
Mechanical engineering, 25
Nuclear engineering, 1
Physics, 36
Education administration, 1
Marine engineering, 1

Aeronomy, total degrees, 24

Chemistry, 2
Electrical engineering, 1
Mathematics, 2
Mechanical engineering, 2
Meteorology, 2
Physics, 15

Life sciences and systems, total degrees, 27

Aeronautical engineering, 1
Biochemistry, 3
Biology, 5
Chemistry, 3
Mathematics, 1
Mechanical engineering, 1
Physiological psychology, 1
Zoology, 2
Anatomy, 1
Bacteriology, 1
Medicine, 1
Pharmacology, 1
Plant physiology, 1
Psychology, 4
Sociology, 1

Flight mechanics, total degrees, 236

Aeronautical engineering, 78
Astronomy, 3
Chemical engineering, 2
Chemistry, 1
Civil engineering, 2
Electrical engineering, 11
Engineering physics, 5
Mathematics or applied mathematics, 45
Mechanical engineering, 41
Nuclear engineering, 1
Physics, 46
Mining engineering, 1

Orbit and trajectory studies, total degrees, 69

Aeronautical engineering, 13
Astronomy, 1
Mathematics, 35
Mechanical engineering, 5
Physics, 10
Aerospace engineering, 1
Education, 2
Geological engineering, 1
History, 1

Data systems, total degrees, 254

Aeronautical engineering, 5
Chemical engineering, 1
Chemistry, 2
Electrical engineering, 57
Electronic engineering or electronics, 8
Engineering physics or engineering science, 8
Geology, 1
Mathematics or applied mathematics, 126
Mechanical engineering, 7
Physics, 32
Education, 2
Education administration, 1
Industrial engineering, 2
Marine engineering, 1
Psychology, 1

THE IMPLICATIONS for higher education resulting from the development of these new aerospace occupational specialties become readily apparent. Any student whose occupational goal is research and development in new fields, such as those in aerospace technology, should make sure he is well grounded in the fundamentals, including mathematics. He should also attempt to complete as broad a training program as possible in science and technology.

This trend toward the fundamentals and away from the academic specialties is recognized in educational circles. Martin A. Mason, dean of the George Washington School of Engineering and Applied Science, in commenting upon new educational approaches established in that institution, said, "We recognize the essential unity of science and technology, of engineering and applied science. In our curriculum, strong emphasis will be placed on knowledge which is fundamental and has continuing application. Major attention will be given to acquisition of competence in theory, analysis, and design, to the end that the individual possesses a means for translating his ideas into reality." (Quoted from the *George Washington University Newsletter*, p. 5, December 1962.)

Probably the most significant benefit we can derive from recognition of the nature of occupational patterns in research and development is in the area of manpower utilization. Since 1947, NASA and its predecessor agency, NACA, have qualified individuals in its technical occupational specialties if they held any of a number of physical science or engineering degrees. This flexibility makes it possible to broaden the sources of recruitment for a particular specialty and adapt the needs of the agency to the supply being produced by the colleges or available at the experience levels. The resulting advantage has been enormous. This practice has enabled NASA to staff new activities effectively and to undertake enterprises which might otherwise have been impossible.

In NASA the percentage of aerospace technology staff members who hold engineering degrees has been shrinking over the past several years. Before 1958, 85 percent of our research and development employees held engineering degrees. This number now stands at 69 percent. This shift coincides with a recent downward trend in the percentage of college students throughout the Nation who major in engineering. There are indications that the distribution of degrees held in NASA is largely a reflection of the supply, since it so closely approximates the total distribution of the degrees in the population from which NASA scientists and engineers are drawn.

The whole NASA occupational system is focused upon making effective use of the American educational system in the complex aerospace field. In all our specialties any of a number of college degrees will qualify. This is because a knowledge of fundamentals, disciplined thinking, and an inquisitive and acquisitive mind are basic requirements. It is not practical for the colleges to turn out orbit and trajectory technologists, antenna technologists, and the like, much as we need people with these abilities. Continued emphasis in the colleges and universities upon a broad subject-matter base, especially in the undergraduate curriculums, is the most meaningful training for NASA's work.

THE CHRONIC SHORTAGE of scientists and engineers is well known. We in NASA feel that one of our responsibilities is to select and make the best use possible of the scientific and engineering talent that is available to us. That is the purpose of our basic manpower program which has found expression in this occupational system.

There are many approaches to the problem of scientific and engineering shortages. Careful staffing, placement, and utilization are only three. Obviously other approaches are necessary, such as the encouragement of greater numbers of qualified young people to enter scientific and engineering curriculums. NASA supports an extensive training program in a number of universities in an effort to obtain the number of qualified engineers and scientists required by the space program.

Staffing at key levels is an important specialized problem. NASA has made great efforts to stimulate the interest of eminent and outstanding technical people in its most important program areas. Opportunity in the form of challenging assignments in a decision-making environment has influenced a number of renowned scientists and technologists to increase their effectiveness in the national scientific efforts by joining the NASA organization. NASA has also attempted to foster organizationally an environment which makes it possible for staff members to concentrate upon essential programs with a minimum of diversion into collateral or less essential activities. A need, a challenge, a responsibility, and a backup capability will often create an attraction greater than the power of money alone upon men of great talent and serious purposes.

Increased emphasis upon womanpower and on the training of women scientists and engineers is another possibility. In NASA there are fewer than 300

(Continued on p. 18)

The Changing Face of Education*

By FRANCIS KEPPEL

The real issue is not whether our students are *better* than those of a generation ago but whether the quality of today's education is sufficient to meet tomorrow's demands, which will be infinitely more complex than those of the past or the present. In other words, it is not a matter of whether our schools are better but whether they are good enough. Walter Lippmann has stated the matter in this way:

> We must measure our education effort as we do our military effort. That is to say, we must measure not by what it would be easy and convenient to do, but what it is necessary to do in order that the nation may survive and flourish. We have learned that we are quite rich enough to defend ourselves, whatever the cost. We must now learn that we are quite rich enough to educate ourselves as we need to be educated.

Not until the next generation shall we know how good or how bad our present educational efforts and accomplishments are. This is the fundamental problem in creating the sense of urgency about educational reform and the need for investment in education. Most of us, I think, feel that education is important, but few believe it to be urgent. This is the challenge that I feel it my duty to put before you. For this is your task, and your responsibility.

Careful planning and concerted action can keep our educational strategies from degenerating into spasmodic responses to the alarms of the moment. But failure to move ahead with all speed can result in our becoming second rate, lacking in trained manpower, lacking in the development of economic resources, and as a result lacking influence, prestige, and strength among the nations.

The potential teachers, doctors, scientists—indeed both the leaders and the followers in all professions—of the 1970's and the years immediately beyond are already moving through our secondary schools. Grade school students should even now be starting to learn the foreign languages and other skills they will need in the complex society of tomorrow. The laws of science span all national and ideological boundaries. This makes science a universal language, a link between nations and a real potential force for progress and peace. Understanding of science, therefore, is coming to be a part of life, not merely a preparation for it.

Our complex domestic and international commitments call for scholars and statesmen skilled not only in diverse foreign languages and in knowledge of other cultures and traditions but also in human understanding in a world subject to continuous change. John Gardner, in the 1962 report of the Carnegie Corporation, suggests the kind of education needed to cope with change; i.e., with "Renewal in Societies and Men":

> If we indoctrinate the young person in an elaborate set of fixed beliefs, we are insuring his early obsolescence. The alternative is to develop skills, attitudes, habits of mind, and the kinds of knowledge and understanding that will be the instruments of continuous change and growth on the part of the young person. Then we shall have fashioned *a system* that provides for its own continuous renewal.
>
> This suggests a standard for judging the effectiveness of all education—and so judged, much education today is monumentally ineffective. All too often we are giving young people cut flowers when we should be teaching them to grow their own plants. We are stuffing their heads with the products of earlier innovation rather than teaching them how to innovate. We think of the mind as a storehouse to be filled rather than as an instrument to be used.

In the last analysis, learning is something each of us must do for himself; and the greater the pace of change in the world, the more urgent becomes the need for education that produces skill in independent learning and decisionmaking. As the focus of education shifts from teaching to learning, from emphasis upon memory to emphasis on creativity, attitudes, and values, a major breakthrough in education is expected from use of programed learning in which films, television, machines, and other devices are used in a coordinated program.

*From an address Commissioner Keppel delivered at the spring conference of the Magazine Publishers Association, Washington, D.C., Mar. 26, 1963.

A new toughness in academic standards is already reflecting the great amount of knowledge that must be learned and applied. With the new advances, gifted students will learn faster and average students will learn better. As teaching and learning improve, tomorrow's students will have far fewer gaps in their knowledge of how to work creatively in unfamiliar intellectual territory, how to pinpoint a problem, how to formulate intelligent questions, and how to evaluate information on which to base answers or to take action.

Society Faces the Needs of Education

Good education costs money, a lot of money. In the foreseeable future, this cost will continue to rise even if we merely accommodate sheer numbers and do nothing at all to improve the quality. For a long time, there have been vast gaps between needs and resources, not only among the separate States but often among the school districts of some of the richer States. Even though poorer States often make a greater tax effort for education than the richer ones, the level of their educational support is often far short of what is customarily regarded as adequate. Much has been said about the need to improve equality of opportunity, to remove disparities of slums and suburbs, to maximize our potentialities for national growth through trained human capital. Several years ago, James B. Conant estimated that by 1958 the "educational deficit," the difference between what was spent and what should have been spent, for the public schools would be between $7 and $8 billion *per year*. The Achilles heel of education is that it goes on, in one form or another, despite all obstacles, which serve only to sap its quality. Sometimes I wish neglect of education could cause it to come to a halt. Perhaps then our concern would become commensurate with the need. Perhaps then we would find that sense of urgency required for action.

We live in an era when progress has become a goal in itself and when research has become a recognized means to this goal. Yet educational research has never had the same urgency as has research related to the needs of medicine, agriculture, and weapons for the national defense.

If we are to improve education, it is not enough simply to provide more of what already exists. To improve the product, we must also improve the process, for education is, after all, a process. Some exciting things are being learned about the educational process. It is unfortunate that many school systems are too poor to profit by some of these findings.

Let me give a few examples. As a result of one Cooperative Research project sponsored by the Office of Education, it is now possible to increase fourfold the rate of listening comprehension of blind children, from approximately 60 to 240 words per minute. Before this important new discovery, the blind were limited to receiving information at frustratingly slow rates through braille or ordinary voice recordings. Through the use of "compressed speech" recordings, the blind may soon be trained to digest reading materials at rates comparable to those of persons with unimpaired sight.

In the area of research dealing with mental retardation, there is new evidence, also gained through the Office's Cooperative Research program, that at least some of the children labeled as "mentally retarded" may merely be the products of "retarded homes." The next step is to determine which "retarded" children are actually "familial retardates," and then to devise educational means of developing and utilizing their otherwise wasted abilities.

Important as current research findings in education may be, they are few in number and their impact is impaired in many areas, chiefly as a result of financial inability to do the best that is known. The more people know about education, the more effective their efforts can be; but there are some who simply do not know that they do not know. You are in a position to set the tone of acceptance—indeed, of demand—for the maximum potential educational opportunity for every American, regardless of age, race, religion, income, and previous educational achievement. Probably only you and your colleagues in the communications media can bring society to the effort necessary to bring to full fruition whatever action—local, State, and Federal—is necessary in the national interest. John B. Cunningham has pointed out: "More than any other medium, magazines reflect the mores and patterns of what is known in any year as 'our times.'" If "our times" are to bring about appropriate, vital improvements in education, the magazines of the Nation must do their part in conveying the necessity of such improvements.

The Federal Government Faces Educational Responsibility

The President in his education message outlined the areas in which the Federal Government should play its part. These included improving quality, providing for unprecedented numbers of students, and increasing opportunities and incentives for all citizens.

H.R. 3000, the proposed legislation on which a number of hearings have already been conducted by the House Committee on Education and Labor, is properly entitled the "National Education Improvement Act." It is a comprehensive program to meet selected and urgent needs of education at all levels; to promote quality education, expand opportunities, and to increase the capacity of our educational institutions, with the overall aim of providing for the Nation's needs in skilled manpower, national growth, and national security.

The bill seeks to provide new opportunities for individuals in higher education by expanding and extending the student loan and graduate fellowship programs of the NDEA. Additional amounts would be made available under the loan program, which has helped bring about major changes in concepts of student financial aid and has opened up new opportunities for thousands of students. A new dimension would be added to the use of credit in meeting higher education costs by providing Federal Government insurance of long-term loans to students from families of moderate means. A considerable increase is proposed in the number of graduate fellowships available to help encourage and sustain those studying for advanced degrees in science and the humanities. Finally, the well-established concept of encouraging our youth to help themselves would be supported by a proposal to provide additional, educationally related, work-study opportunities for college students.

The bill would help institutions of higher education to expand and improve through loans for academic facility construction and grants for libraries, graduate school development, and programs of technical education. Aid would be provided for the construction of public community and junior colleges—a matter of lively interest at this time.

Most of us would agree, I think, that the most significant factor in the learning process, next to the aptitude of the learner, is the quality of instruction. The bill is concerned with the essence of quality, the preparation and continued improvement of teachers. It seeks to broaden and improve programs of teacher preparation and inservice training, with special emphasis on the subjects to be taught or being taught. In addition, the bill would provide expanded and accelerated educational research and demonstration efforts.

Improved research and teacher training, however, are not enough if good teachers do not choose to enter or remain in the profession. We have heard much of salary problems, lack of incentives, and industry competition; we know that each year valued professional teachers leave the schools never to return.

The bill includes a cooperative approach to some of the key problems of public elementary and secondary education, including those of the teacher. Provisions are made to assist the States in undertaking through their own State plans selective and urgent improvements in the public schools. These would include substantial increases in the salaries of career teachers, increases in starting salaries that are exceedingly low, and increases in the salaries of teachers in economically disadvantaged districts; constructing classrooms in areas of critical and dangerous shortage; and initiating pilot, experimental, or demonstration projects to meet special educational problems, particularly in slums and depressed rural and urban areas.

In vocational education, the bill is designed to help alleviate and anticipate some of the situations arising from the changes in our industry and technology. By expanding the scope and level of vocational education programs now in effect, and by adding specialized grants in aid, I believe the new proposals will strengthen State and local efforts to train and retrain individuals to fit them for our changing technology.

The bill also provides funds for preparing teachers of the handicapped and for research projects in the special education of such children.

Finally, the bill deals with the problems of providing education and library services for those who seek or require educational training beyond the regular formal years of schooling. It has become increasingly apparent that education does not and should not end, whether it be with a high school diploma or a master's degree. Many of our citizens, with different levels of formal education, now seek

and need opportunities for continuing education in various fields. An estimated 8 million Americans 25 years of age and older have less than 5 years of schooling, and almost 23 million have less than an 8th-grade education.

In order to help provide much greater opportunities for learning by adults, the new legislation would authorize grants to States for the expansion of university extension centers and would make additional grants to aid States in adult basic education programs. Special grants (amendments to the existing Library Services Act) would enable States to expand facilities and services in both urban and rural libraries.

Today the demands of national security and economic growth have joined our traditional concern for equality of opportunity for the individual—a concern which you have cherished since the earliest days. We are, I think, experiencing a complete reassessment of the key role of education in our society, because it serves not only the individual; it is essential to our way of life and our security.

The schools and colleges and universities, the libraries and the laboratories that have served us so well in the past must be greatly strengthened and expanded to meet their future responsibilities. We rightly take pride in the freedom and independence of these institutions. The policy of the Federal Government, in planning its part in the effort we must make as a Nation, must be such that at the end of any program the insitutions are stronger and freer than they were at the start. I am profoundly convinced that independent institutions and freedom of learning and teaching are the fundamental basis of our society.

The administration's program as presented to the Congress is designed to combine the forces of education for their common task and to strengthen them for the heavy responsibilities they must bear. No one of us in the administration, I am sure, would claim that the interrelated proposals are so well formed that improvements are impossible. On the contrary, we actively seek criticism and will give the most serious consideration to proposals for change. But we do insist that the time has come in our history to face the whole problem, from preschool through adult education.

The proposed program takes political and economic reality into account. It is concerned with the undeniable facts of the needs of the economy and of the students and educational institutions. It was designed to deal with the equally undeniable facts of current opinions and judgments on sensitive areas of public policy. It calls upon many groups to sacrifice hopes of long standing; it asks of others that they accept policies on the form in which funds are provided or the categories of institutions to which they are limited, which they may regard as inadequate or even unfair.

Yet in elementary and secondary education I believe that there is substantial consensus among educators as well as the lay public that children in the public schools should be taught in safe and healthy surroundings, that their teachers should be well selected and well trained, that those teachers of high quality who wish to make teaching their lifelong career be provided with salaries high enough to make such a career possible and competitive with other professions, and that the shocking problem of slum schools in city and country should be solved at once.

The administration's program for the schools is aimed at these problems. It is based on a diagnosis of our educational health and prescribes medicines specific to the diseases that must be cured. On these matters it is reasonable to insist that all the forces of education have an obligation to unite—public and private, schools and colleges, humanists and scientists alike.

OFFICE OF EDUCATION *Studies* AND *Surveys*

Education for the Superior Student

Talent and Tomorrow's Teachers: The Honors Approach, by Lanora G. Lewis, No. 11 in the series *New Dimensions in Higher Education*, has just been released by the Office of Education. The report is based upon the verbatim transcript of the proceedings of an April 1962 conference of the Inter-University Committee on the Superior Student.

Some of the highlights of the report are:

● Honors programs serve a dual purpose in relation to teacher education. They provide an appropriate type of approach which attracts superior students; at the same time, they can give teacher candidates opportunities to acquire the kinds of

effective learning experiences on which they may capitalize later in their work with talented students in the schools.

- Cooperative planning by the faculty of subject disciplines and those of professional education contributes to fertile exploration of the content, methods, and ends of education. This can result in a close functional relationship between teachers of the arts and sciences and teachers of education as they seek those methods which enhance and enrich the learning experience and cause the student to handle the content with which he is dealing in a more efficient manner.

- In planning programs for students who progress at a rate and depth greater than that of average students, teachers acquire broader insight into teaching-learning situations and better understanding of practices of flexible progression.

- To accommodate differences in students' learning rate and depth, schools need new measures of accomplishment. Furthermore, certification requirements could well be modified in some States to guarantee quality without imposing unnecessary restrictions through formal course requirements.

- Honors programs have been and will continue to be proving grounds for many of the practices through which teaching-learning experiences of all students are being improved. Judicious provision of honors programs at all levels of education can not only make it possible to nurture the talents of superior students wherever and whenever they can be identified but can also contribute to improvement of regular programs.

The report is available (OE–50036) from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., for 35 cents.

More on Dropouts

FURTHER information on dropouts has been supplied by one of the institutions participating in the Office of Education study of college applicants, entrants, and dropouts conducted by Robert E. Iffert and Betty S. Clarke. Initial findings of the study were reported in *Higher Education*, March 1963, pp. 20–21.

A study conducted by Rebecca C. Tansil, director of admissions at Maryland State Teachers College, Towson, reports some of the results of giving dropouts another chance. The study covers students who dropped out of the teacher education program at the Towson institution in the 10-year period beginning in September 1951.

The study shows that of 336 students who withdrew in the 10-year period (260 voluntarily and 76 because they were required to do so by the college) and reentered, 201 have graduated, and 38 are still enrolled in college, bringing the total potential graduates up to 239. The remainder of the students withdrew again—60 voluntarily and 37 at the request of the college.

Of the 260 students who dropped out voluntarily and later reentered, 160 have graduated, 27 are still in college, and 73 withdrew again. Of the 76 students who withdrew at the request of the college and later reentered, 41 have graduated, 11 are still in college, and 24 have dropped out again.

The percentage of potential graduates in the group who withdrew voluntarily and later reentered is 72. For the group who withdrew originally at the request of the college and later reentered, the percentage of potential graduates is 68. Both of these percentages exceed those for graduates in normal progression from each entering class (50–54 percent) over the same 10-year period.

International Education

Expanding Alliance Programs in Education

More than 35 U.S. universities are or will be shortly carrying on educational programs in Latin America, Teodore Moscoso, U.S. Coordinator for the Alliance for Progress, announced recently.

Under the sponsorship of the Agency for International Development, these universities are or will be working in 15 Latin American countries with more than 50 universities and colleges, representing a quarter of all such institutions in Latin America.

AID, under the Alliance for Progress program, is also cooperating in teacher training projects in 15 Alliance countries. Other prospective Latin American teachers are being trained under AID sponsorship at five U.S. centers—Pennsylvania State, Geneseo State in New York, Akron University in Ohio, and Wisconsin and Indiana Universities.

Other AID-sponsored education programs under the Alliance provide for production and distribution of 2½ million paperback first- and second-grade readers to half a million schoolchildren in Central America and construction of more than 8,000 classrooms in 9 Latin American countries.

Alliance Education Programs for Costa Rica

Two agreements recently signed under the Alliance for Progress will aid in improving public education in Costa Rica. The two programs authorized in the agreement will help the Government of Costa Rica increase primary and secondary school enrollments, add to the number of qualified teachers, and improve the quality of instruction at the University of Costa Rica.

Although about 30 percent of Costa Rica's national budget is spent for education, the country has found it difficult to keep pace with its rapidly growing school population. About 51,000 children of primary school age do not attend school at all, and of a secondary school age population of 122,000, only 22,000 attend classes.

To help eliminate this problem and ease a critical shortage of teachers, the Agency for International Development will contribute $235,000 to the Government of Costa Rica to enlarge and improve facilities at the country's three normal schools. The Costa Rican Government is providing an additional $81,000, which includes funds for labor for construction of the three schools located in Heredia, Liberia, and San Ramon.

A second AID grant for $112,436 will assist Costa Rica in developing future leaders, planners, and researchers by improving academic standards at the University of Costa Rica. AID assistance will provide for advanced professional study for faculty members, for employment of specialists as needed, and other services. The University of Costa Rica will provide supporting services, estimated at $103,000, including office space, secretarial and office staff, transportation, and other services which may be required.

U.S. and Venezuela Continue Education Program

Venezuela and the United States are continuing a cooperative program initiated in 1961 under the Alliance for Progress to improve secondary education and teacher training in Venezuela. The Agency for International Development has announced that both governments will share in the continuing costs of the program. Venezuela will contribute $435,000; AID, $122,421.

The program provides for educational and training opportunities for Venezuelan teachers in the United States, curriculum development and organization, preparation of instructional material, guidance and other student services, national planning, supervision and administration, consultant services, and technical assistance.

Since the installation of representative constitutional government in 1959, Venezuela has expanded and improved educational facilities and opportunities. Enrollment in primary schools has nearly doubled during the last 4 years and tripled in secondary schools. Total expenditures for education in 1961–62 were 166 percent greater than in 1956–57 and represented 3.7 percent of the country's gross national product.

In the Office of Education

● A conference on technical assistance training programs in education was held April 17–19 in the Office of Education. The purpose of the conference was to present program objectives, evaluate past programs, and discuss administrative relationships with participating institutions. The technical training section of the Bureau of International Education conducted the conference.

● Eleven Congolese educational administrators returned home on March 5, 1963, after completing a 5-month tour of local and State organizations to become acquainted with the philosophy and organization of U.S. education. The group, who will be developing the secondary school system in the Congo, visited schools and organizations in Puerto Rico, Ohio, Michigan, Maryland, and Washington, D.C.

A NEW ISSUE of the Educational Materials Laboratory Report, prepared by Lois Belfield Watt, has been released by the Office of Education. The report, "Classing Curriculum Guides and Related Publications," is available by OE number (OE–14031–22) without charge from the Publications Distribution Unit, U.S. Office of Education, Washington 25, D.C.

OE program notes

National Defense Education Act

Many former language fellows are teaching

A GREATER NUMBER of former holders of NDEA Modern Foreign Language Fellowships are now engaged in teaching than in any other occupation, according to a preliminary review of answers to a questionnaire recently sent to the 600 former fellows whose tenure had expired on or before June 30, 1962.

Designed to help evaluate the effectiveness of the fellowship program toward meeting the Nation's growing need for teachers and other persons competent in modern foreign languages, the questionnaire sought information concerning the present occupations of former fellows and the value of the fellowships to their careers. More than 380 replies have been received.

A sampling of responses revealed several broad patterns:

- About 40 percent of the respondents were engaged in teaching, 20 percent were continuing their studies without the aid of title VI fellowships, and a little less than 10 percent had entered Government service. The other 30 percent were employed in various occupations.

- The great majority of former fellows—about 85 percent of the sample—were using the languages of their awards in their present occupations. Most of them were using the language to a maximal extent, a small number to a moderate extent and an even smaller number to a minimal extent.

- Most title VI fellows use their awards for study toward graduate degrees; about two-thirds of the sample group had received or were candidates for M.A. or Ph. D. degrees.

MLA to evaluate summer 1963 language institutes

THE Modern Language Association of America, under contract with the U.S. Office of Education, will evaluate the 79 NDEA Language Institutes scheduled for the coming summer, and survey a sample of persons formerly enrolled in institutes to determine the influence of the institute experience on their effectiveness as teachers.

Panels of MLA consultant-evaluators will visit each of the 79 institutes during the summer and interview directors, faculties, and students. The data obtained will be reviewed at a fall meeting of institute directors and incorporated into a summary report that will present the best features of the 1963 institutes and serve as a basis for planning future programs.

During the spring and summer of 1963, MLA will send a questionnaire to a sample of the 1,500 foreign language teachers who attended NDEA Language Institutes from 1959 through 1962, seeking information on the value of the institutes to their careers. An analysis of responses to this questionnaire will be reported to the Office of Education.

The entire project will be completed by June 1964 at a cost of about $46,500 in funds provided under title VI (Language Development) of the National Defense Education Act. The project director will be Donald D. Walsh, director of the foreign language program of the Modern Language Association.

1963–64 modern foreign language fellowships awarded

COMMISSIONER of Education Francis Keppel has awarded 826 fellowships to graduate students of modern foreign languages for study in 1963–64. The awards were made through the modern foreign language fellowship program authorized by title VI of NDEA. This brings the total number of language fellowship awards during the first 5 years of the program to about 3,300, and the number of individual students aided to about 2,000.

The 1963–64 fellows will study 58 languages at 51 graduate schools. Of the 826 fellowships, about 450 were renewals of fellowships awarded in one or more of the previous 4 years of the program.

Seventy-two percent of the fellows, or 595, will study 7 languages which the Commissioner has designated as requiring first priority in development: Arabic (87), Chinese (100), Hindi-Urdu (54), Japanese (75), Portuguese (60), Russian (135), and Spanish (84). The remaining 231 fellowships are in languages of lesser priority which are spoken in Africa, Asia, Europe, and Latin America.

The 826 fellowship recipients were chosen from among 3,267 applicants at 77 colleges and universities.

Total cost of the regular language fellowship awards for 1963–64 will be $3.2 million.

The modern foreign language fellowship program is designed to increase the number of trained linguists in languages of critical importance to the United States. Fellowships are awarded to qualified graduate students preparing for college teaching, for Government service, or for service in nonprofit, nonsectarian organizations.

Conferences

Conference on talent development

On April 29–30 the U.S. Office of Education, in cooperation with the University of Virginia; the Region III Office of the Department of Health, Education, and Welfare; and the Departments of Education of Kentucky, Maryland, North Carolina, Virginia, West Virginia, the District of Columbia, the Commonwealth of Puerto Rico, and the territory of the Virgin Islands, sponsored a Conference on Talent Development in Charlottesville, Va.

A major purpose of the conference was to bring together interested and knowledgeable persons—State department of education personnel; college administrators and professors; public school principals, supervisors, and teachers; key members of educational associations; and influential lay people—whose common concern for talent development might strengthen efforts in schools and colleges to provide more effectively for able children and youth.

Ralph C. M. Flynt, Associate Commissioner, Bureau of Educational Research and Development, delivered a major address at the conference. Other principal speakers included the Honorable Bert Combs, Governor of Kentucky; Arthur Hitchcock, executive secretary, American Personnel and Guidance Association; Virgil S. Ward, professor of education, University of Virginia; Perry E. Gresham, President, Bethany College; and Sidney J. Parnes, director of creative education, University of Buffalo.

Among the issues examined were "Providing for Talented College Students," "Creativity—an Evolving Concept," "Independent Study and Honors," "Preparing Teachers To Develop Talent," and "New Media and Talent Development." Conferees were also given the opportunity to examine in advance and react to at the conference four propositions intended to clarify the respective roles of the State and the Federal Government in talent development.

Conference on public administration

The 1963 National Conference on Public Administration, sponsored by the American Society for Public Administration, took place in Washington, D.C., April 3–6. Panels and workshops covered such subjects as public school administration, international development, and university research.

The Office of Education had a special exhibit of publications on public educational administration on display. Secretary Anthony J. Celebrezze of the U.S. Department of Health, Education, and Welfare was a keynote speaker on the topic "Change and Challenge in Public Administration." About 1,500 people attended the conference.

Other Program Notes

Public Health Service

National Institutes of Health

Applications for 1965 research associate appointments

Applications for July 1965 appointment as clinical associate or research associate in the research and clinical investigations programs conducted by the National Institutes of Health are being accepted. September 15, 1963, is the deadline for completed applications. Candidates who are entering internship in July 1963 and those with more advanced training will be considered. Applications for a limited number of 1966 and 1967 appointments in some institutes will also be considered.

Candidates must apply on the standard NIH application form. Pertinent dates in connection with the NIH clinical associate and research associate program are:

March–September 6: Application materials available.
September 15: Deadline for receipt of completed applications.
October 7–25: Interviews by invitation.
November 5: Notification of successful candidates.

Information and application forms may be obtained from Dr. Murray C. Brown, Chief, Clinical

and Professional Education, Clinical Center, National Institutes of Health, Bethesda 14, Md.

Grants and fellowships

DURING the first 8 months of fiscal year 1963, the Public Health Service awarded 11,659 research grants and 2,875 fellowships totaling $301,461,360.

The awards were made by the National Institutes of Health and the Bureau of State Services of the Public Health Service, acting upon recommendations from national advisory councils and other consultative groups, with the NIH Division of Research Grants acting as coordinator.

Information booklet on NIH available

A GENERAL informational booklet, "National Institutes of Health" (PHS Publication No. 81), has been completely revised and is now available. It contains chapters on NIH growth, progress, and organization, and brief articles describing the functions and activities of its offices, divisions, Clinical Center, and its research Institutes.

Single copies may be obtained without charge from the Office of Research Information, NIH, Building 31, Room 5B–40, Bethesda 14, Md.

Federal aid to nursing education, service, and research

A REPORT entitled "Toward Quality in Nursing: Needs and Goals" has been released by the Public Health Service. The report contains recommendations by the Surgeon General's 24-member Consultant Group on Nursing.

Among the major recommendations made by the group were: new programs of Federal aid for stimulation of nurse recruitment, assistance to nursing schools for construction of educational facilities, and for improved nursing education programs, loans and scholarships for nursing students, and financial assistance to State, regional, and national agencies for recruitment programs for nurses and other health personnel.

The report (PHS Publication No. 992) may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D.C., for 50 cents a copy.

College fires and accidents to be studied

A NATIONAL Campus Safety Association conference will be held July 8–17 at Iowa State University. The conference, sponsored by the Division of Accident Prevention of the U.S. Public Health Service, the Psychology Department at Iowa State University and the university's Engineering Extension Service, will investigate fires and accidents on college campuses.

Estimates place the number of college student accidental fatalities at 3,000 and injuries at 370,000 each year. The National Fire Protection Association has reported that campus fires have increased 40 percent in number and 60 percent in losses. More than two out of every three colleges and universities have had significant losses from fires in 1961. These constitute only a small fraction of the 30,000 fires which occur on campuses each year, but which are not reported because they are minor and do not result in deaths or injury.

Indian nurses graduate

THIRTY-TWO INDIAN GIRLS from eight States received graduation certificates February 27 from the Indian School of Practical Nursing at Albuquerque, N. Mex. The graduates will be placed by the Division of Indian Health of the Public Health Service in its facilities throughout the United States.

The Indian School of Practical Nursing, a PHS school established in 1935, was set up to provide an opportunity for Indian girls to obtain training in a useful occupation and to furnish hospitals with a group of workers with an understanding of the Indian. Applicants must have one-fourth or more Indian blood and be high school graduates.

Of the 388 students who have graduated from the last 15 classes of the school, the great majority remain in service in Indian hospitals and clinics.

National Aeronautics and Space Administration

Space, science, and urban life conference

THE Nation's first space, science, and urban life conference was held March 28–30 in Oakland, Calif. The conference brought together 150 leaders of industry, labor, education, and government to explore techniques for translating basic research findings and new technology of the space age into practical programs to solve the problems of rapidly

expanding metropolitan areas. Such urban problems as air pollution, water supply, public health, communication, and power resources were discussed.

The conference was supported by the Ford Foundation and the National Aeronautics and Space Administration in cooperation with the University of California and the City of Oakland.

Atomic Energy Commission

DURING November and December 1962 the Atomic Energy Commission awarded 100 life science research contracts with a total value of $2,714,965.

The contracts were signed with universities, colleges, and private institutions as a part of the AEC's continuing policy of assisting research and development in fields related to atomic energy.

Area Redevelopment Act

MORE than 150 training courses in 80 job categories were approved in the last half of 1962 for approximately 6,000 unemployed men and women living in redevelopment areas in 33 States, Commissioner Keppel announced recently. This brings to about 15,000 the number who have been helped under the Area Redevelopment Act.

The Secretary of Health, Education, and Welfare, through the U.S. Office of Education, provides assistance to State vocational agencies in developing training plans. Courses are conducted by public vocational authorities. The Secretary of Labor designates the occupations and selects the trainees.

The Area Redevelopment Act has been followed by the Manpower Development and Training Act of 1962. The latter legislation, administered jointly by the Departments of Labor and of Health, Education, and Welfare, also provides vocational training for unemployed and underemployed people, but is not limited to redevelopment areas. Programs may be established in any community of the Nation where job opportunities for trained workers are found. Approximately 18,000 people are currently in training or will soon enter MDT programs.

Books USA

THE U.S. Information Agency (USIA), together with seven publishers of paperback books, has undertaken a nonprofit program called BOOKS USA.

Each of the publishers has made up one or more packets of outstanding American books, averaging about nine books per packet. The packets are in categories such as American literature, history, and science. Each packet is turned over to the USIA for distribution by USIA posts in the area or country designated by the purchaser.

Books may be purchased in the following packets:

A. Two Years Before the Mast, Dana
Manhattan Transfer, Dos Passos
The Edge of Sadness, O'Connor
Life on the Mississippi, Twain
The Red Pony, Steinbeck
A Single Pebble, Hersey
Three Plays, Wilder
Seventeen, Tarkington
The Sea Wolf, London
Cimmarron, Ferber

B. Carl Sandburg's Abraham Lincoln (4 vols.)
The Red Badge of Courage, and 4 stories
Emerson: An Anthology
Wings of the Dove, James
Emily Dickinson: Selected Poems
Famous American Plays of the 1930's

C. Helen Keller: The Story of My Life
Huckleberry Finn, Twain
A History of the United States, Miller
You Can't Go Home Again, Wolfe
Longfellow: Selected Poems
Whitman: Selected Poems
Turn of the Screw and Daisy Miller, James
Famous American Plays of the 1920's
Better English, Lewis

D. Mark Twain, edited by Fuller
Great American Short Stories
Moby Dick, Melville
Poe: Selected Poems
Whittier: Selected Poems
Modern American Painting and Sculpture
F. D. Roosevelt and the Age of Action
Modern American Dictionary

E. The American Reader (in five volumes)
Herndon's Life of Lincoln
Foundations of American Constitutionalism
John Randolph, Adams
Democracy, Adams
American Notes, Dickens

F. Mentor Book of Major American Poets
The Apprenticeship of Hemingway, Fenton
Catcher in the Rye, Salinger
Arrowsmith, Lewis
Age of Innocence, Wharton
Troll Garden, Cather
Pale Horse, Pale Rider, Porter
Appointment in Samarra, O'Hara

G. Good Reading, Committee on College Reading
Dictionary of American-English Usage, Nicholson
New American Webster Handy College Dictionary

New American Roget's College Thesaurus
New American Medical Dictionary and Health Manual
Speak Better—Write Better—English, Coon
How to Spell and Increase Your Word Power
Reader's Companion To World Literature

H. History of Western Art, Christensen
Music and Imagination, Copeland
Sunrise at Campobello, Schary
My Fair Lady, Lerner
Act One, Hart
The Story of Jazz, Stearns
The Painter's Eye, Grosser
American Skyline, Tunnard and Reed

I. The Pathfinder, Cooper
Life On The Mississippi, Twain
Tom Sawyer, Twain
The Red Badge of Courage, Crane
Moby Dick, Melville
Leaves of Grass, Whitman
Basic Selections From Emerson, Lindeman
A Week On The Concord and Merrimack Rivers, Thoreau

J. Autobiography and Other Writings, Franklin
George Washington, Cunliffe
The Civil War, Hansen
The Age of Jackson, Schlesinger
The United Nations and How it Works, Coyle
American Diplomacy, 1900–50, Kennan
The Public Philosophy, Lippmann
The American Presidency, Rossiter

K. English Through Pictures, Book 1
First Steps in Reading English
A First Workbook of English
English Through Pictures, Book 2
The Merriam-Webster Pocket Dictionary
Roget's Pocket Thesaurus in Dictionary Form
Word Power Made Easy
The Complete Letter Writer
Six Minutes a Day to Perfect Spelling
Short Cuts to Effective English, Shefter
Shefter's Guide To Better Compositions

L. Profiles in Courage, J. F. Kennedy
The Autobiography of Benjamin Franklin
Facts About the Presidents, Kane
The Doctors Mayo, Clapesattle
My Several Worlds, Buck
Three Plays About Abraham Lincoln
A Pocket History of American Painting
The Man From Main Street
The Making of the President

M. The Red Badge of Courage
Pocket Book of Modern American Short Stories
The Scarlet Letter, Hawthorne
Moby Dick, Melville
The Pocket Book of O. Henry Stories
The Adventures of Huckleberry Finn
The Whitman Reader
New Pocket Anthology of American Verse
The Deerslayer, Cooper
The Legend of Sleepy Hollow and Other Stories

N. The Household Encyclopedia
The Pocket Cook Book
Chifferes Family Medical Encyclopedia
Baby and Child Care, Spock
The Rand McNally Pocket World Atlas
A Complete Guide to Home Sewing
A Pocket History of the U.S., Nevins & Co., Commager
What We Must Know About Communism, Overstreet
Shorter Bartlett's Familiar Quotations

O. Living Earth, Farb
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National Science Foundation

Fellowships for science graduate study

THE National Science Foundation recently awarded 1,880 graduate fellowships in the sciences, mathematics, and engineering for the academic year 1963–64. The recipients were selected from 6,122 applicants from all parts of the United States and its territories. Of the 1,880 new fellowships, 437 were in the life sciences, 1,348 in the physical sciences and a number of interdisciplinary fields, and 95 in certain areas of the social sciences.

NSF graduate fellows may attend any appropriate nonprofit U.S. or foreign institution. Fellowships provide basic stipends of $1,800 for the first level of graduate study, $2,000 for the intermediate level, and $2,200 for the terminal year. They include additional allowance for tuition costs, assessed fees, dependents, and limited travel.

The Foundation expects to reopen the graduate fellowship program for 1964–65 in October 1963.

Grants to State academies of science

NSF has made 57 grants totaling $526,445 to 36 State academies of science and similar institutions for the support of activities aimed at improving science education. The grants will support projects during the 1963–64 academic year in 32 States, the District of Columbia, and Puerto Rico.

Secondary teachers receive summer fellowships

THE National Science Foundation has awarded 288 summer fellowships to secondary school teachers of science and mathematics.

The 288 recipients will undertake individually planned programs of graduate study and research, lasting from 6 to 12 weeks, at colleges and universities; 240 of the fellowships provide for 2 or 3 successive summers of training, and the remaining 48 are for 1963 only.

The awards are for 125 teachers of mathematics, 118 of the life sciences, 38 of the physical sciences, and 7 of general science.

Inservice institutes for elementary schools

NSF has made grants to 46 colleges and universities in 27 States and Puerto Rico to conduct institutes for elementary school teachers. The institutes will provide supplementary training in science and mathematics during the 1963–64 school year for about 1,400 elementary school teachers, supervisors, and principals.

More conferences for college teachers

ELEVEN COLLEGES and universities will receive approximately $172,100 in grants in support of conferences for college teachers of science, mathematics, and engineering. These grants, in addition to the 24 conferences previously announced (see *Higher Education*, February 1963), will make it possible for approximately 1,000 college teachers to become familiar with recent advances in their fields. Participants are chosen by the conference directors, not by NSF.

FERGUSON—*from p. 6*

women scientists and engineers. They work at all levels including top program direction. However, they represent only 3.2 percent of our technological staff, and their number shows little likelihood of growing markedly. Women simply do not enter the engineering professions in significant numbers. In the aggregate United States in 1959–60, only 0.4 percent of the baccalaureate engineering degrees were conferred upon women. Why do they shun engineering? NASA believes this problem deserves further study.

THERE are continuing efforts to relieve the general shortage of technical employees through Federal legislation and local initiative as well as through NASA's own information and training programs.

NASA employs several thousand persons in nondegree technician and experimentalist occupations. These employees perform a distinctive and highly important service complementing the work of professional and shop employees.

On the one hand, professional staff members in the aerospace technologies do research in the space sciences, plan programs, determine experimental requirements, and supervise the design and operation

of flight vehicles and other hardware systems. These professional occupations, as we have seen, require a college degree in a technical field, and many of them, advanced degrees. On the other hand, shop employees in the mechanical trades and crafts fabricate and assemble specialized equipment and produce experimental hardware which goes into our research and development programs.

NASA requires technicians and experimentalists to do another type of work which is done by neither of these groups. Essentially it consists of the development and use of specialized techniques where the primary requirement is skill and talent in experimental applications. This work is not usually specifically identified with any recognized trade or craft, nor is it subprofessional in the sense of being subordinate to or leading up to professional work. It is not quasi-scientific or quasi-engineering. It is an essential component of our primary manpower capabilities in its own right. It is necessary to the success of our projects. It includes highly creative work. However, it is founded in the practical problems of meeting specialized experimental requirements, not in scientific abstractions.

In NASA this experimentalist function is performed throughout many projects and programs. It is the heart of electronic miniaturization and subminiaturization. It exists in certain fabrication processes, in designer-draftsman activities, in inspection and quality control techniques, and in many operational activities. It is almost always associated with complex problems or activities requiring skilled handling of temperamental and sophisticated equipment.

Some of this work is performed by specialists paid at rates established by local wage boards. The remainder is performed by employees in specialized occupations under the Civil Service Classification Act.

NASA experimentalists come from one primary and two secondary sources. The primary source of these employees is the internal training programs. The two secondary sources are the other research and development organizations, including the Armed Forces, and the graduating classes of technical schools and junior colleges or those who do not complete 4-year scientific or engineering curriculums.

Our training of technicians is usually in two phases. The initial training consists of a planned program of several years' duration combining formal course work with practical experience in our technical facilities on a rotating basis. Upon completion of this training all but a selected group enter the mechanical trades as journeymen. For the remaining trainees the secondary training begins with assignment to a specialized experimental function. This training is highly work oriented and is designed to permit close association with our most capable and successful senior experimentalists who train by leadership and by example.

NASA has less than one experimentalist for every two scientists and engineers in the aerospace technologies. We believe that a desirable ratio for the future would be one experimentalist for every 1.5 professionals. This could be accomplished by transferring carefully selected mechanical craftsmen to experimentalist occupations such as those concerned with quality control, test and evaluation, and other activities related to the management and coordination of contracted work.

As of January 1, 1963, NASA had 25,667 employees. This number is expected to rise to approximately 31,000 by 1964. The upward trend in percentage of staff who are scientists and engineers is expected to continue through 1970, when it is estimated that approximately 40 percent of the anticipated NASA staff will be scientists and engineers. If NASA should obtain the desired ratio of one experimentalist to 1.5 scientists and engineers, NASA will require a considerable expansion in its staff of experimentalists.

It is necessary to consider NASA's manpower needs in relation to the overall probable supply and demand throughout the entire economy. In NASA the needs for scientific technologists and experimentalists go hand in hand. Although these two types cannot be substituted for one another, they can and do complement each other. NASA Administrator James E. Webb has called for balance in the national effort in all fields of human knowledge, including space exploration. Whatever the long-range manpower requirements may be for NASA and the Nation as a whole, it is clear that America's colleges and universities, as essential components of our free enterprise system, will play an increasingly vital role in the provision of trained manpower.

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(2) *Free Publications: Request direct from the agency issuing them.*

From the Office of Education

Civil and Highway Technology: Suggested Techniques for Determining Courses of Study in Vocational-Technical Education Programs, by the Division of Vocational and Technical Education. 1962. 20 p. 25 cents. (OE–80018)

The Educational Media Program: Selected Educational Media Program Publications, by the Educational Media Branch. January 1963. 6 p. Free. (OE–34023)

Electronic Data Processing—I: A Suggested 2-Year Post High School Curriculum for Computer Programers and Business Applications Analyst. Technical Education Program Series No. 4. 1963. 49 p. 40 cents. (OE–80024)

Engineering Enrollments and Degrees, 1961, by Wayne E. Tolliver and Henry H. Armsby. 1963. 45 p. 35 cents. (OE–54006–61)

International Teacher Development Programs, 1960–61: Annual Report to the Bureau of Educational and Cultural Affairs, U.S. Department of State, by the Teacher Development Section, 1962. 71 p. Free. (OE–14003–61)

The Major Principles of Physics, Chemistry, and Geology of Importance for General Education, by Harold E. Wise, W. Edgar Martin, and Ellsworth S. Obourn, December 1962. 27 p. 20 cents. (OE–29025–A)

Nonpublic Secondary Schools: A Directory, 1960–61, Showing Accreditation Status, Enrollment, Classroom Teachers, and Other Data, by Diane B. Gertler and Leah W. Ramsey. 1963. 106 p. 75 cents. (OE–20043)

Summaries of Studies in Agricultural Education: An Annotated Bibliography of Studies in Agricultural Education with Classified Subject Index. Vocational Division Bulletin No. 300, Agricultural Series No. 78 (Supplement No. 15 to Vocational Division Bulletin No. 180). 1962. 51 p. 25 cents. (OE–81002–61)

Title VII—New Educational Media: News and Reports, by Edith Rodano and Perry Guedry, editors. February 1963. 21 p. Free. (OE–34002–8)

From Other Government Agencies

Metropolitan Area Distribution of Scientific and Technical Personnel, 1960. Scientific Manpower Bulletin, No. 18. 4 p. 5 cents. (National Science Foundation, NSF 62–33)

1962 Salaries and Characteristics of Scientists in the National Register of Scientific and Technical Personnel. Scientific Manpower Bulletin, No 19. December 1962. 10 p. 15 cents. (National Science Foundation, NSF 62–47)

Science and Engineering Professional Manpower Resources in Colleges and Universities, 1961. A Preliminary Report. January 1963. 12 p. 15 cents. (National Science Foundation, NSF 63–4 No. 37)

U.S. Atomic Energy Commission Programs for Nuclear Educational Assistance. June 1962. 24 p. Free. (University Relations Division, Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tenn.)